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ABSTRACT

Protocol analysis, a technique that uses people's verbal reports about their cognitions as they engage in an assigned task, has been used in a number of applications to provide insight into how people mentally plan, assess, and carry out those assignments. Using a system of networked computers where actors communicate with each other over terminals and simultaneously talk aloud their thoughts, researchers can gain insight into people's cognitions during conversations. Participants converse over a computer-mediated channel, while simultaneously providing verbal protocols about their thoughts. It takes participants at least two conversational sessions before they begin to feel comfortable using and interacting on a mediated system. Examples from protocol data and past research illustrate how plans, evaluation, attributions, and shared experiences are activated during conversations. Advantages of the design are: it offers a new sort of data; data collection is easy once conversationalists are acquainted with the system; and there is much potential for investigating questions about cognition and/or interaction. Limitations include: the extent to which verbal protocols reflect cognition specific to the conversation; the sheer amount of time and effort to transcribe the videotapes; and questions regarding participants' varying ability to provide oral protocols. Analysis of protocol concurrent to conversation through a computer-mediated channel offers a unique opportunity to map cognition during interaction. (Contains 11 references.) (RS)

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Protocol Analysis as a Method for Analyzing Conversational Data

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RUNNING HEAD: Protocol Analysis

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Abstract

Protocol analysis (Ericsson & Simon, 1984), a technique that uses people's verbal reports about their cognitions as they engage in an assigned task, has been used in a number of applications to provide insight into how people mentally plan, assess, and carry out those assignments. Likewise, protocol procedures can be used to examine conversation. Using a system of networked computers where actors communicate with each other over terminals and simultaneously talk aloud their thoughts, researchers can gain insight into people's cognitions during conversations. This paper describes the method of observation, illustrates some findings, and identifies the investigative potential and limits of the method.

Protocol Analysis as a Method for Analyzing Conversational Data

One of the most enduring beliefs in the field of communication is that the processes of forming and expressing messages begins with cognition. While scholars may argue over the level of control and consciousness actors have over these processes (Kellerman, 1992), or the extent to which conversation can be considered a "mindful" activity (Bavelas & Coates, 1992), most agree that the link between what goes on in people's heads, what comes out of their mouths, and what they perceive to be happening in their environment is more than randomly fired neurons. To be sure, in viewing the mind as an integral part of individual and social conduct (Mead, 1934), as opposed to the brain, one is allowed to make inferences about the so-called human condition, and how this condition differs from that of non-humans.[1]

Scholars studying associations between the mind and communication generally take one of three approaches. Some experimentally manipulate a variable related to cognition and make inferences about cognition based on the influence of that variable on participants' behaviors. Others use more descriptive approaches to draw conclusions about speakers' cognitions from observations of natural or reconstructed texts. Still others take a retrospective approach and ask people to recall and describe their thoughts following interaction. Each of these yield important data concerning cognition and communication, yet they share a common limitation. Each is unable to reveal participants' concurrent cognitions--the thoughts people have simultaneous with the communication event.

Our interests are to help fill this topographical void. Since there is evidence associating cognitive processes to interaction before and after a communication event, we can expect there are associations during the event as well. The obvious

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[1] The mind is a complex, multi-levelled, abstract construction. While the mind includes levels of unconsciousness that also explain the uniquely human outlook on life, self, and other, we speak more to those properties that can be used to account for how humans socially interact.

problem is an inability to actually view the abstract entity of the mind during conversations. Pencil-paper measures that ask people to select or write messages they would employ in hypothetical situations may tell us how thoughts arrange talk prior to interaction. On the other hand, having people orally describe what is going on in their minds while they complete a pencil-paper measure may tells us more about the "on-line" cognitive activity during interaction than the measure itself.

Protocol analysis, (Ericsson & Simon, 1984), a technique that uses people's verbal reports about their cognitions as they engage in an assigned task, has been used in a number of applications to provide insight into how people plan, assess, and carry out those assignments. Since it is impossible for people to provide verbal reports during their conversations with another, we've devised a means whereby actors converse with each other through a computer-mediated channel, while simultaneously providing the researcher with verbal descriptions of their cognitive activity. The remainder of this paper will describe our method of gathering protocol concurrent to conversation, illustrate some collected data, and discuss the potential and limits of this method. Throughout this paper, we refer to mediated conversations as simply conversations, even though there are physical differences between the two.

Setting Up A System and Gathering Concurrent Protocol Data

Ericsson and Simon (1984) summarize that in fields such as cognitive psychology and educational research, participants are often asked to think aloud as they compose a brief paragraph, solve a math problem, or complete some other task. What they say as they work through a task helps scholars understand the cognitive mechanisms involved in that task. While the verbal descriptions themselves may not be the actual processes that occur, those self-descriptions may be used to test and develop theory on cognition and task fulfillment.

Using such a method for conversations, however, is problematic given that the channel required to provide verbal descriptions of thought is occupied with

providing speech to a conversationalist. Unlike the mind, which because of its multi-levels of complexity can perform many simultaneous functions, the mouth can only perform one function in a given time space. At issue then is how to leave the vocal channel available for providing descriptions of cognition but attain some sense of conversation structure not available from alternative mediums like letter writing.

This issue was addressed by Daly et al.(1989) who devised a method that uses two separate channels for communication: one for the oral protocols, and one for the conversations. Participants converse over a computer mediated channel, while simultaneously providing verbal protocol about their thoughts. Both protocol and conversations are recorded for analysis. Since the conversationalists' computer terminals are in separate rooms, neither participant has access to the others' verbalized thoughts during the interaction.

Minimally, the design requires: two computer terminals placed in separate locations, but linked to a common networking system; two video cameras; two video recording units; two audio mixers; and two microphones. Networking systems and software programs vary, but electronic interact software that process and send information on "real time" are the most desirable. The research facilities for the Communication Studies Department at the University of Iowa, for instance, use NetWare by Novell Inc. on an IBM compatible system. The system runs a program specially written for collecting concurrent protocol data (see Daly, Vangelisti, Weber, Maxwell, & Neel, 1989). That program allows all messages to be sent as they are being entered by a user. Currently, there are four terminals on line, although the program is capable of serving five users at the same time.

Conversationalists are led into separate rooms, each equipped with a table, chair, keyboard, monitor, camera, recorder, sound mixer, and microphone. Separating participants allows each to provide oral protocols that reflect their thoughts without worrying how those thoughts will affect their partner. The keyboard is placed

directly in front of the participant, while the camera is placed just behind, focussed on the terminal screen. Camera obstructions are avoided by placing the terminal screen a little to the left or right of the conversationalist, rather than directly in front of him/her. Although most cameras are equipped with a microphone, we've found them to be of little use, especially since many utterances of protocol are mumbled under breath. External microphones then are hooked up to a sound mixer and fed into the recording unit. Clip-on microphones have been most effective, but directional table microphones suffice.

Depending on the research question, participants are instructed to describe their thoughts as they converse with another over the computer terminals. As actors converse, each camera unit records the text as it appears on the respective screens, and verbalized thoughts as they are uttered throughout the interaction. Recording the text rather than the participant allows the researcher to identify where oral protocol and mediated communication meet as well as diverge. Videotapes are then transcribed into conversation (text as it appears on screen) and protocol (recorded utterances).

While the actual means of gathering protocol data is much the same, variance in interaction programs give the researcher more or less flexibility. For instance, the software used at the University of Iowa allows users to access another by "calling" their ID number, and having that other "pick up". Each users' screen is split into five areas, one area per user. As many as five users can participate in a conversation at the same time. Each area contains an ID for each user so that all on-line know who is "speaking." Entered text appears within the area of that user. Users must specify, then, who they are talking to when conversations are open to more than two members. The program is also able to produce a printed copy of the conversation as it entered and was processed by the network server, providing accurate points of turns and "speaking" time.

The software program processes and sends information to all on-line screens as it is entered by the user. Unlike most E-mail programs, then, it is not necessary to produce an entire text before sending it. Likewise, a respondent, upon viewing the text as it is entered by another, can "interrupt" as well as "talk-over" while the other is still entering text. Hence, interaction on the system occurs in "real time" since, like talk, messages are immediate and non-retractable.

Research questions underlying investigation greatly influence how verbal protocols are gathered. Participants may be asked to provide specific information or global descriptions about their thoughts. We've found that by stating our purpose as a global one we receive the greatest amount and range in oral protocol (e.g., "Simply to record whatever is on your mind as you talk to another over the computer"). More specific protocol requests tend to produce less protocol overall (e.g., "To record the attributions you make about another's statements. An attribution is...").

To train participants, we have the pair watch a 20 minute video that illustrates cognition during conversation (a scene from "Annie Hall"), explains the method as a means to meet our research needs, and demonstrates the actual method by showing one person's side of the mediated conversation. After viewing the tape, participants are shown the entire system to clarify any questions about the method, and to alleviate any fears regarding privacy. Unlike other studies of conversations, many participants want to make sure that their partner or others will not have access to their thoughts. After going through step-by-step instructions with each person on how to use the system, we run participants through a 20 minute practice session. The total amount of time required for training, completing consent forms and answering questions, is about 90 minutes.

Although some of our data involve a confederate conversationalist, many of our studies are of interaction between pairs who have been in some type of relationship for over two years. Because concurrent protocol is generally information

unavailable to others, extra steps to maintain confidentiality are taken. First, participants are given a computer terminal ID to use and store information. That ID is used on accompanying diaries, logs, and questionnaires. Second, while it is sometimes necessary to monitor the conversations to ensure that the system is working appropriately, researchers and assistants do not monitor the protocol of the conversationalists. Third, conversationalists have the opportunity to stop or erase recorded data at any time. Fourth, assistants involved with collecting data are not allowed to view or transcribe those video tapes.

It takes participants at least two conversational sessions before they begin to feel comfortable using and interacting on a mediated system. In fact, most pairs find the medium to be a novel experience. The extent to which participants feel comfortable or are able to verbalize their thoughts, however, seems to be a more personal matter. Initially, we had a research assistant in the room with each conversationalist, prompting them to verbalize what was on their mind. Obviously, this produced anxiety for some participants. We now place a small tape player near the computer terminal that randomly plays messages such as, "What are you thinking about?" or "Keep talking aloud" every 30-40 seconds. After the two sessions, participants begin to tune out the taped message and produce protocol at their own ease.

While we initially attributed the matter of minimally produced protocol to cognitive overload, there does not seem to be a clear relationship between how easy actors find the computer system to use and how easy they find it to verbalize their thoughts. Nor does there seem to be a relationship between how at ease actors are in conversing and how easy they find verbalize thoughts. This matter in and of itself poses interesting questions regarding cognition, complexity, and verbal ability.

Samples of Collected Data

Analysis of protocol concurrent to interaction is applicable to any number of communication events. However, our focus here is to illustrate the type of data this method may provide to help inform us of the cognitive processes related to everyday conversation. These examples were drawn from our protocol data and past research to illustrate how plans, evaluations, attributions, and shared experiences are activated during conversation. In every case, the computer mediated conversation is displayed in the left column; the protocol is in the right. Text that is contained within parentheses represents statements that the participant is reading from his/her computer screen. Participants' reports of their thoughts are underlined.

Plans

This excerpt illustrates conversational planning. Plans are projected actions based on generalizations from repeated similar experiences. In this case, the generalized scene is initiating a relationship with a stranger. After S notes her name and asks about her partner's class schedule, she begins to plan what she will say after her partner responds. This plan is not articulated to S's conversational partner, but is verbalized in her protocol.

CONVERSATION	PROTOCOL
S: My name is Leslie. I know someone named Holly in my Spanish class, do you take Spanish?	S: Okay, (my name is Leslie. I know someone named Holly in my Spanish class. Do you take Spanish?) So now, well, I'm just waiting to hear what she's ing to say. If she says yes then I guess I'll probably ask her probably her major or try and find something else we have in common.

Evaluations

During conversation, listeners sometimes evaluate what their partner says. These evaluations prompt a speaker to question whether or not to continue the direction of

conversation. That decision is often dependent on the attributions made about the speaker or utterances. In the example that follows, a confederate (L) has just disclosed some relatively intimate information (concerning her family's financial status) to M. M responds in his protocol (but not in conversation) with an evaluation of L's statement, noting that the utterance was not appropriate ("she's not supposed to say this").

CONVERSATION	PROTOCOL
L:...and my parents are going to need some financial help.	M: I'm sure. Oh wow. Oh, I'm sure she's telling me this and I haven't even met her yet. What am I supposed-- I feel bad but God, she's not supposed to say this the first time. I mean, I can't even see her face.

Attributions

Attributions are causal statements that assist in making sense of a situation, event, or behavior. Generally, attributions are made of conditions that a person finds positive, negative, or confusing. In the following excerpt, the participants (A & B) have been discussing a third party (Sue). Just prior to the excerpt, A appears to become agitated that this third party "went out" the previous evening. In the conversation, B questions A's agitation by asking, "Wasn't Sue supposed to be going out or something?" In her oral protocol, however, B concurrently makes a number of attributions about A's behavior. These are attributions that B chooses not to express in the conversation.

CONVERSATION	PROTOCOL
B: Wasn't Sue supposed to be going out or something?	B: (Wasn't Sue supposed to be going out or something). maybe she [Sue] was just joking. You're taking things so literally that you do this computer thing because you don't even see it as emotion...you just take what they say as what.

After contrasting her behavior with behaviors previously described by her conversational partner, G. makes an attribution about her own behavior. Again, this is an attribution she chooses to withhold from her partner.

CONVERSATION	PROTOCOL
G:...Chris and I never do things like that together, but I'm not very romantic.	G: (never do things like that together) <u>but I'm not that type of person</u>. (I'm not very romantic) <u>Yuk. I'm not that type of person...</u>

<u>Shared Experiences</u>

One factor that is often used to differentiate conversation in interpersonal from non-interpersonal relationships is the use of mutual knowledge (Planalp & Benson, 1992) and shared experiences to process and anticipate interaction. Unlike generalized scenes which can be used to explain how conversations are organized and produced (Kellerman, Broetzmann, Lim, & Kitao, 1989), the shared experience is a unique and specific event that forms some locus of meaning for interpersonal pairs. In this example, M & B have been in a romantic relationship for over two years. M is reminding B of their plans to go pick a pumpkin out for Halloween. M begins her sentence which prompts B to recall the shared experience. B anticipates what M is going to say, and accurately finishes her sentence. In the following two examples, conversation utterances are spaced to provide you the reader with a sense of time. Note how B's protocol is fully verbalized before M can get five words out.

CONVERSATION	PROTOCAL
M: Don't f orget to bring the pumpkin knife like you did last year... Ha ha...Did you think I forgot?	B: (Don't f) <u>orget to bring the pumpkin knife like you did last year!</u> *{laughter]* <u>I knew she'd bring that up</u>! *{laughter}* (Ha ha Did you think I forgot?) <u>No</u>.

As revealed in her own protocol, M's utterance is more than just a randomly produced statement. Her own thoughts reflect the same experience. What is very interesting in this case is that both participants are thinking of the same incident at the same time, rather than B's thoughts being activated after M's utterances.

CONVERSATION	PROTOCOL
M: Don't forget to bring the pumpkin knife like did last year...Ha ha...Did you think I forgot?	M: I wonder if he thinks I forgot about him not bringing the knife last year? *{laughter}* (Did you think I forgot?)

Potential and Limits of the Method

Before discussing the potential and limits of this method, our use of it must be put into proper focus and context. The focus is cognition, the context is conversation.

Although the method may not produce interaction which precisely mirrors the structure and form of conversation, there are advantages of the design. First, it offers a new sort of data. Most generally, it provides researchers with a means of observing and analyzing the thoughts that people have as they engage in a communication event. While these verbal reports may not assess all, or even most of the cognitions that occur, they very likely tap those thoughts that are most salient or available. Further, because participants report on their cognitions as they occur, researchers do not need to make judgements or inferences about the nature of those cognitions based on respondent behavior. Instead, the protocols provide a ready interpretation of cognitive processes associated with particular behaviors.

Second, while getting started is a time consuming task, collecting data is rather effortless once conversationalists are acquainted with the system. Most of our conversational pairs looked forward to their weekly interaction sessions and reported being satisfied with their conversations even after six meetings. To be sure,

participants generally found the idea of collecting thoughts during conversation to be interesting and offered additional information regarding their thoughts and conversations once the studies were over.

Third, there is much potential for investigating questions about cognition and/or interaction. For example, how do conversationalists manipulate codes to overcome interaction constraints inherent in the system? In one case, a "speaker" deleted his entire entry at the completion of his turn so that his partner would not "read too much" in to what he was saying. In another case, a "speaker" entered jibberish to let his partner know that he was frustrated and was no longer "listening" to her statements. In still another case, a speaker typed a single key consecutively to symbolize that she was pausing, and had not yet completed her turn. In many cases, conversationalists capitalized all words to express anger.

Concerning cognition, more work can be done on the attributions actors provide for their own or others' behavior. For example, what reasons can "speakers" provide for not choosing to disclose or express information to another at the time of conversation? As illustrated by Vangelisti, Miller, and Aleman (1992), actors often choose to express some attributions, and withhold others during conversations. Past work has provided taxonomies of reasons people report for not expressing their thoughts to another, yet how these correlate with reasons made at the time of the conversation remain unknown.

Relatedly, little is known of how people process emotion during conversation. People's emotive responses vary with a number of interactional and interpersonal factors (see Bowers, Metts, & Duncanson, 1985). Yet, aside from the study of neural firing, physiological arousal, and vocalic--noverbal cue during deception, little has been done to investigate people's emotive responses during conversation. There seems to be much to gain then by mapping how people describe their emotions as related to messages received, sent, anticipated, and recalled. Such study should keep

in mind, however, the differences in sensory, intellectual, and emotional biases of media, and how those biases may impact user response.

As with any method, there are several limitations in collecting and analyzing protocol data. The first is the extent to which verbal protocol reflects cognition specific to the conversation. That is, while the mind is capable of performing many simultaneous functions, the production of verbal protocol itself is a behavioral activity influenced by cognitive processes. Participants may then attempting be addressing two distinct but simultaneous goals: communication with a partner, and communication with the researcher. The extent to which participants tailor their oral protocol for this or other purposes at this point is unknown. Researchers must further investigate, then, the validity and generalizability of verbalized thoughts made during conversation, mediated or otherwise.

The second is the sheer amount of time and effort required to transcribe videotapes for analysis. Each tape contains two sets of data: the conversation in textual form; and the protocol in verbal form. Transcribing the conversation is a tedious task of reading text as it was recorded off the terminal screen. Transcribing the protocol is a tedious task of wading through mumbled utterances. Additionally, aligning protocol with the conversational text can be a tiresome effort, especially if the research question requires a careful and accurate matching of text as it appears on the terminal screen with the uttered thoughts. This point is even more dramatic if both conversationalists' thoughts are to be compared to the appearing text.

Finally, there are a number of questions regarding participants' varying ability to provide oral protocol. As stated, whether or not a person feels comfortable or is able to verbalize their thoughts seems to be an individual rather than situational factor. Cognitive overload and communicative demand may be one reason for these differences. Excessive involvement in the conversation may be another. Concern for privacy may be still a third. The point is, like the variables that influence

participation in naturally occurring, face-to-face conversation, it is difficult to identify variables that affect the production of protocol, or that interact with related conversation variables.

Clearly, computer-mediated conversations are not identical to face-to-face or even telephone conversations. Aside from the absence of nonverbal and vocalic information, computer-mediated codes differ from verbal messages in physical and symbolic form, both of which create biases of that medium. The physical form of computer mediated interaction is spatially biased (Innis, 1951). Despite that the software program processes information in "real time" and thereby makes messages "non-retractable" the second they are entered, those messages are conveyed in a literate form. Unlike oral messages, written code allows a receiver to "go back" and re-read what has already been "stated." Hence, there is less reliance on memory. Further, because literate messages remain visibly "frozen" in the context of the preceding and subsequent utterances, processing those messages is more efficient than processing verbal messages. At the same time, the continued presence of that text inclines one to constantly re-interpret its meaning as new text appears. This process understanding computer mediated text may be seen as analogous to what Ong (1982) would probably describe as "secondary literacy."

On the other hand, the method has tremendous potential to increase our understanding of how new media forever change the way communication is understood. The increasing public demand for and access to computer-mediated networking systems (e.g., Internet, Prodigy), the development of electronic relationships, the formation of international network communities, and the building of information superhighways all suggest that major effort should be directed to cognition and mediated interaction. Through continued observation of protocol during mediated interaction, researchers may be able to log the transformation of a communicating society and the changing of a collective consciousness (Innis, 1951).

To sum, analysis of protocol concurrent to conversation through a computer-mediated channel offers a unique opportunity to map cognition during interaction. While there are limits to how far collected data can be generalized to face-to-face interaction and "ordinary" conversation, data are nonetheless quite revealing. To be sure, perhaps the limits of this method may not be in the shortcomings of its "conversation-like" features, but in holding face-to-face interaction as the ideal model upon which other forms of interaction are measured.

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